

1
2 PROCESSING OF AN INTERRUPTION TO A COMMUNICATION CONNECTION
3 BETWEEN A DOMESTIC APPLIANCE AND A CONTROLLER IN A LOCAL
4 NETWORK

5
6 [001] The invention relates to a method and a device for
7 determining an interruption of a communication connection
8 between a domestic appliance connected in a local area
9 network to which further domestic appliances are optionally
10 connected, to a bus line arrangement comprising a bus line
11 controller, and the relevant bus line controller to which
12 information about its respective appliance status is
13 transmitted by the relevant domestic appliance, and for the
14 continuation of such transmissions on re-establishing the
15 communication connection after eliminating the interruption,
16 wherein the relevant domestic appliance is allocated a
17 unique address for its identification in the local area
18 network.

19
20 [002] A method and a device for transmitting information
21 signals or data between a domestic appliance and a bus line
22 controller connected to a bus line arrangement have already
23 been described elsewhere (see, for example, DE 100 56 492 A1
24 and DE 103 13 360 A1). However, no further details are known
25 in the relevant context relating to the determination of
26 interruptions of communication connections from and to the
27 domestic appliances and relating to measures for resuming
28 the transmission of information signals and data from and to
29 these domestic appliances after eliminating the
30 interruptions.

31
32 [003] Interruptions of communication connections from and to
33 domestic appliances connected to a local area network pf a
34 bus line arrangement comprising a bus line controller can be

1 caused by short-term faults or by building modification or
2 by long-term faults. When information or data on the
3 respective appliance status is to be transmitted
4 independently in the relevant local area network by the
5 domestic appliances contained in said network without a
6 separate request (see, for example, DE 102 60 143 A1), in
7 order to keep the loading of the local area network as low
8 as possible, in the event of the occurrence of an
9 interruption of the respective communication connection, no
10 notification of the relevant interruptions is available to
11 the device to which the relevant information or data is
12 transmitted, that is usually the afore-mentioned bus line
13 controller connected to the bus line arrangement to which
14 the afore-mentioned local area network is connected. In
15 principle, it would be possible to transmit the information
16 or data from the respective domestic appliance in response
17 to corresponding requests which were to be directed to the
18 relevant domestic appliances. However, this would result in
19 considerable undesirable loading of the afore-mentioned
20 local area network and the bus line arrangement belonging
21 thereto. Thus, such a measure for determining interruptions
22 of communication connections from and to domestic appliances
23 does not come into consideration.

24

25 [004] It is thus the object of the invention to provide a
26 way whereby in a method and a device of the type specified
27 initially, an interruption of a communication connection
28 between a domestic appliance which is connected to a bus
29 line arrangement comprising a bus line controller in a local
30 area network, and the relevant bus line controller can be
31 determined and in addition, transmissions of information
32 from and to the relevant domestic appliance can be resumed
33 when the communication connection is re-established after
34 the relevant interruption in a simple manner and with a

1 particularly low loading of the local area network and the
2 bus line arrangement pertaining thereto.

3

4 [005] The object indicated hereinbefore is solved in a
5 method of the type described initially according to the
6 invention whereby when said information is transmitted
7 merely in the form of alteration information from said one
8 domestic appliance on its respective appliance status to the
9 bus line controller, a certain fixed criterion of said
10 domestic appliance is repeatedly requested over time by the
11 bus line controller whereupon if the communication
12 connection exists with the relevant domestic appliance, a
13 response signal is transmitted therefrom to the bus line
14 controller,

15

16 [006] the absence of such a reply signal is considered to be
17 an interruption of the communication connection with the
18 relevant domestic appliance,

19

20 [007] whereupon a search operation for the relevant domestic
21 appliance is carried out by the bus line controller until a
22 reply signal is obtained from said appliance again,

23

24 [008] and then information corresponding to the then valid
25 current status of the relevant domestic appliance is
26 transmitted to the bus line controller.

27

28 [009] The invention has the advantage that firstly, the
29 loading of the local area network together with the bus line
30 arrangement can be kept low as a result of the fact that
31 only alteration information on its respective status is
32 transmitted by the relevant domestic appliance to the bus
33 line controller and secondly, a relatively low loading of
34 the relevant local area network and the bus line arrangement

1 can be achieved in order to determine the existence of an
2 interruption of the communication connection with the
3 relevant domestic appliance and to resume transmissions of
4 information from and to the domestic appliance concerned.
5 Since the bus line controller merely requests a certain
6 fixed criterion of said domestic appliance repeatedly over
7 time, the extent of loading of the local area network and
8 the bus line arrangement can be kept relatively low since
9 different appliance statuses of the relevant domestic
10 appliance are not requested which would mean a more
11 elaborate request procedure and therefore a higher loading
12 of the local area network and the bus line arrangement.
13 Also, the search operation for the relevant domestic
14 appliance within the local area network carried out in the
15 absence of a reply signal from the domestic appliance does
16 not involve any very substantial loading of the relevant
17 local area network and the bus line arrangement. In the
18 course of the relevant search operation, the bus line
19 controller can transmit a certain interrogation signal which
20 is only answered by that domestic appliance to which the
21 communication connection was interrupted. The relevant
22 interrogation signal, which can optionally be the same as
23 that with which the bus line controller repeatedly requests
24 a certain fixed criterion of said domestic appliance over
25 time, can be recognised by the relevant domestic appliance
26 whose communication connection was interrupted, for example,
27 from the circumstance that this interrogation signal could
28 not be received during a specified time interval in the
29 domestic appliance.

30

31 [010] Finally, the bus line controller can then be
32 synchronised to the current states of the domestic appliance
33 being considered by information corresponding to the current

1 status of the relevant domestic appliance at this time being
2 transmitted to said controller.

3

4 [011] Preferably both the requesting of the specific fixed
5 criterion of said domestic appliance and said search
6 operation are both carried out cyclically, for example,
7 every minute. Preferably, the respective appliance principal
8 status, that whether the relevant domestic appliance is
9 switched on or off is requested as the specific fixed
10 criterion of said domestic appliance. This means a
11 particularly low interrogation loading of the local area
12 network and the relevant bus line arrangement since merely
13 an ON status or OFF status is requested and a corresponding
14 reply signal (for example, 1 or 0) is to be transmitted.

15

16 [012] Since it can be expected that an interruption of the
17 communication connection between the afore-mentioned
18 domestic appliance and the bus line controller can be a
19 longer-term interruption which, for example, lasts several
20 hours or days and in addition, one or more further domestic
21 appliances can be connected in the meantime to the local
22 area network to which the relevant domestic appliance is
23 connected, it can arise that in the course of a registration
24 procedure for registering the respective further domestic
25 appliance in the local area network and therefore on the bus
26 line arrangement, an address is issued which had previously
27 been allocated to the domestic appliance whose communication
28 connection is now interrupted. Such a registration procedure
29 is given, for example, in the other citation already
30 mentioned (DE 103 13 360 A1). In this case, it is
31 advantageous if the information relating to the current
32 status of said domestic appliance is only transmitted after
33 the relevant domestic appliance has been allocated a unique
34 address at this time by a registration procedure in the

1 local area network. As a result, uniqueness is ensured with
2 regard to the addressing of the domestic appliances
3 belonging to the afore-mentioned local area network.

4

5 [013] Secondly, the object specified above is solved in a
6 device of the type specified initially according to the
7 invention whereby when said information is transmitted
8 merely in the form of alteration information from said one
9 domestic appliance on its respective appliance status to the
10 bus line controller, the bus line controller repeatedly
11 requests over time a certain fixed criterion of said
12 domestic appliance, if the communication connection exists
13 with the relevant domestic appliance, said bus line
14 controller receives a reply signal from said appliance in
15 each case,

16

17 [014] said bus line controller comprises an evaluation
18 device which, in the absence of a reply signal, provides a
19 message signal indicating an interruption of the
20 communication connection to the relevant domestic appliance

21

22 [015] and the bus line controller is further constructed so
23 that in response to said message signal, it carries out a
24 search operation for the relevant domestic appliance until a
25 reply signal is obtained from said appliance again,

26

27 [016] and it then allows information corresponding to the
28 then valid current appliance status of the domestic
29 appliance to be received.

30

31 [017] This results in the advantage of an overall
32 particularly low expenditure on apparatus to keep the
33 loading of the local area network and the bus line
34 arrangement as low as possible.

1
2 [018] More appropriately, the bus line controller is a
3 controller which cyclically requests said certain fixed
4 criterion of the relevant domestic appliance and also
5 cyclically conducts said search operation. A particularly
6 low expenditure on control is hereby achieved.

7
8 [019] Preferably, the relevant bus line controller is a
9 controller which cyclically repeatedly requests the
10 principal status of said domestic appliance. Such a
11 controller advantageously causes a particularly low loading
12 of the local area network and the bus line arrangement
13 pertaining thereto.

14
15 [020] In order that the afore-mentioned registration
16 procedure can be carried out with a particularly low
17 expenditure, the bus line controller is more appropriately
18 designed such that before receiving said current status of
19 the relevant household appliance, it includes this domestic
20 appliance in a registration procedure by which means said
21 relevant domestic appliance obtains a unique address at this
22 time in the local area network by which it can be reached in
23 the local area network.

24
25 [021] The invention is explained in detail hereinafter with
26 reference to an exemplary embodiment.

27
28 [022] Figure 1 is a schematic diagram showing a local area
29 network containing a plurality of domestic appliances with a
30 bus line arrangement comprising a bus line controller, to
31 which a further communication network is connected via an
32 interface device, to which for example a participant station
33 formed by a personal computer is connected.

34

1 [023] Figure 2 is a schematic diagram illustrating the
2 sequence of different processes in connection with a
3 domestic appliance shown in Fig. 1.

4

5 [024] Figure 1 is a schematic diagram showing a plurality of
6 domestic appliances HG1 to HGn which can be different
7 domestic appliances of the same household or different
8 households such as washing machines, electric cookers,
9 dishwashers, microwaves, refrigerators, fume extraction
10 hoods, air conditioning plants, coffee machines, vacuum
11 cleaners, cooking hobs, freezers etc. The relevant domestic
12 appliances HG1 to HGn are connected by means of their
13 relevant interface devices IF11 to IFn1 using directionally
14 operated connecting lines or connecting leads CB11 to CBn1
15 to further interface devices IF12 to IFn2 which are
16 connected by means of corresponding connecting lines CB12 to
17 CBn2 to a bus line arrangement BUS. All these connecting
18 lines and the bus line arrangement form a local area network
19 LAN. At this point, it should be noted that the local area
20 network LAN can be a wireless network (radio network) or a
21 wired network, for example, the usual power supply network
22 of the domestic appliances.

23

24 [025] A bus line controller BM designated as a bus master is
25 connected to the afore-mentioned bus line arrangement BUS.
26 In the present case, this bus line controller BM is the
27 communication partner for the domestic appliances HG1 to
28 HGn. Transmissions of information take place between the
29 domestic appliances HG1 to HGn and the bus line controller
30 BM as part of communications. Thus, requests are directed to
31 the individual domestic appliances HG1 to HGn by the bus
32 line controller BM and information signals or data are
33 transmitted to the bus line controller in response to these
34 or without these in the domestic appliances HG1 to HGn. In

1 the latter case, appliance status data, for example, more
2 accurately alteration information are transmitted from the
3 individual domestic appliances HG1 to HGn to the bus line
4 controller BM.

5

6 [026] With regard to the bus line controller BM it should be
7 noted here that this can be a bus line controller used to
8 operate bus line arrangements for example. In addition, the
9 relevant bus line controller can be formed together with the
10 interface devices IF12 to IFn2 by so-called bus couplers as
11 has already been described elsewhere (see DE 103 13 360 A1).

12

13 [027] A further network NET is connected to the bus line
14 arrangement BUS shown in Fig. 1 by means of an access device
15 GW known as gateway in English. In the present case,
16 connected to the further network NET for example is a
17 personal computer PC as a communication station of a user of
18 the domestic appliance or appliances HG1 to HGn. The further
19 network NET can, for example, comprise the internet or a
20 separate local area network such as an ethernet or the GSM
21 network for example. Furthermore, further communication
22 stations can be connected to the relevant further network
23 NET which are allocated to various domestic appliances. In
24 addition, a plurality of further networks with relevant
25 communication stations can be connected to the bus line
26 arrangement BUS by means of their own access devices.

27

28 [028] The information made available by domestic appliances
29 HG1 to HGn of the bus line controller BM is supplied by said
30 controller via the intercommunication gateway GW and the
31 further network NET to the personal computer PC for the
32 corresponding display of information.

33

1 [029] In the present case the device shown schematically in
2 Fig. 1 operates in such a manner that in each case only
3 information signals or data relating the status alterations
4 of the respective appliance status are transmitted to the
5 bus line controller BM by the individual domestic appliances
6 HG₁ to HG_n. As a result, the data loading on the bus line
7 arrangement BUS is kept relatively low. Corresponding
8 alteration information signals or data are provided by the
9 bus line controller BM either on separate request or
10 specifically to the particular user in question or in the
11 present case, their personal computer such as the personal
12 computer PC via the intercommunication gateway GW and the
13 further network NET.

14

15 [030] If a fault or an interruption, hereinafter called
16 interruption for short, occurs in the connecting lines CB₁₁,
17 CB₁₂ or Cb_{n1}, Cb_{N2} connecting the respective domestic
18 appliance HG₁ to HG_n to the bus line arrangement BUS or the
19 bus line arrangement BUS itself in the configuration
20 explained hereinbefore, neither the bus line controller BM
21 nor the user of the personal computer PC can identify a
22 fault therefrom. In order to solve this problem, the present
23 invention has been created, which is now explained in detail
24 using the schematic diagram in Fig. 2.

25

26 [031] Before the present invention is discussed in detail,
27 it should first briefly be explained how the device shown in
28 Fig. 1 operates in normal mode.

29

30 [032] After a domestic appliance has been connected to the
31 bus line arrangement BUS, this domestic appliance is first
32 allocated a unique domestic address by the bus line
33 controller BM in the course of its registration within the
34 local area network LAN comprising the bus line arrangement

1 BUS. The address allocation for this purpose can take place,
2 for example, as explained in detail further below.

3

4 [033] After the relevant domestic appliances has been
5 registered and thus a unique domestic appliance address has
6 been allocated, various information or data relating to the
7 domestic appliance, such as the type of domestic appliance,
8 e.g. washing machine, the embodiment of the relevant type of
9 domestic appliance, the appliance number of the domestic
10 appliance etc. are all transmitted to the bus line
11 controller BM. All this information or data is then retained
12 in the bus line controller BM for various tasks, such as for
13 example, for carrying out remote inquiries or remote
14 diagnoses relating to the relevant domestic appliance.

15

16 [034] Figure 2 shows three perpendicular bar lines which
17 symbolise a domestic appliance, the bus line controller BM
18 shown in Fig. 1 and the personal computer PC also shown in
19 Fig. 1. Arrow lines plotted between the relevant bar lines
20 each designate processes taking place or delivered messages.

21

22 [035] A region with normal information transmission
23 designated as NI is illustrated in the upper area of Fig. 2
24 wherein merely alteration information AI on the respective
25 appliance status of the relevant domestic appliance HG is
26 transmitted from the relevant domestic appliance HG to the
27 bus line controller BM. This alteration information is
28 optionally passed on W to the personal computer PC.

29

30 [036] In the second region in Fig. 2 considered from above,
31 processes are illustrated which take place in addition to
32 the normal information transmission NI between the relevant
33 domestic appliance HG and the bus line controller MB.
34 According to these additional processes, the bus line

1 controller BM makes a cyclic request ZA for a certain fixed
2 criterion from the domestic appliance HG, especially for the
3 respective appliance principal status (ON, OFF). If such a
4 cyclic request remains unanswered OA, this is assessed in
5 the bus line controller MB as an interruption U of the
6 communication connection with the relevant domestic
7 appliance HG and specifically, for example, by a separate
8 evaluation device which delivers a message. Thereupon, a
9 corresponding message M can be optionally delivered to the
10 relevant personal computer PC, according to which the
11 relevant domestic appliance HG is "offline" so to speak,
12 that is an interruption U to this domestic appliance HG
13 exists.

14

15 [037] Thereupon, a search S for the relevant domestic
16 appliance HG takes place in the local area network LAN shown
17 in Fig. 1. This search which can take place cyclically like
18 the previously mentioned inquiry, every minute for example,
19 is continued until there is a reply A from the relevant
20 domestic appliance HG. At this point, it should be noted
21 that a general inquiry signal BS (broadcast signal in
22 English) is sent out by the bus line controller BM in the
23 course of the afore-mentioned search whereby, for example,
24 by including the appliance number of the domestic appliance
25 HG which has "been lost" to a certain extent, this appliance
26 is searched for quite specifically and until the searched-
27 for domestic appliance HG answers after the interruption U
28 has been lifted.

29

30 [038] Another possibility for searching S and determining
31 the "lost" domestic appliance consists in the relevant
32 domestic appliance HG, which has not received any more
33 inquiry signals since the interruption U of its
34 communication connection, delivering a reply signal merely

1 from this finding in response to the incoming general
2 inquiry signal after the relevant interruption has been
3 lifted, which reply signal in turn lets the bus line
4 controller BM know that the previously "lost" domestic
5 appliance HG has been found again.

6

7 [039] In response to the processes explained hereinbefore, a
8 registration procedure RP then runs in the device shown in
9 Fig. 1 as illustrated in the third region from above in Fig.
10 2. In the course of this registration procedure RP, an
11 address is allocated by which the unique address at this
12 time is allocated to the domestic appliance HG. As mentioned
13 above, a unique address is allocated to each domestic
14 appliance in the local area network LAN. If such a domestic
15 appliance can no longer be reached as a result of an
16 interruption or fault of its communication connection with
17 the relevant local area network LAN, it can arise that the
18 address allocated to this domestic appliance is allocated in
19 the meantime to another domestic appliance which is
20 connected to the relevant local area network as a new
21 domestic appliance. For this reason, according to the
22 present invention a current address at this time is now
23 allocated as part of the afore-mentioned registration
24 procedure RP to the domestic appliance HG whose
25 communication connection was previously interrupted or
26 disturbed. The associated address allocation can take place
27 as has already been described in the other citation
28 mentioned initially (DE 103 13 360 A1).

29

30 [040] In the course of this address allocation, the bus line
31 controller BM generates addresses and delivers these via the
32 bus line arrangement BUS. If such an address D1, D2 has
33 already been allocated for a domestic appliance, this is
34 notified to the bus line controller BM to a certain extent

1 as "objection" E1, E2. Thereupon, the relevant bus line
2 controller BM tries with a different address DN until a
3 "positive" answer is finally present, that is no "objection"
4 is raised. The address is then allocated to the domestic
5 appliance HG in the network LAN as the domestic address
6 under which the relevant domestic appliance can be uniquely
7 reached in the local area network LAN. This address
8 allocation thus corresponds to an address searching
9 procedure which is described as trial and error in English.
10 At this point it should be noted that the allocation of
11 addresses can not only take place in the manner explained
12 previously but can also proceed in a completely different
13 manner. For example, the relevant allocation of addresses
14 and therefore the registration of the individual domestic
15 appliances can take place, for example, using a central
16 address allocation device connected to the bus line
17 arrangement BUS.

18

19 [041] In Fig. 2 two attempts at allocation of addresses with
20 the respective address being declined are indicated in the
21 region designated as registration procedure. Only the third
22 attempt at allocating an address is successful without being
23 declined so that the domestic appliance is now allocated an
24 address which uniquely designates it in the local area
25 network LAN.

26

27 [042] After the interruption U of the communication
28 connection with the relevant domestic appliance HG has been
29 lifted and the relevant domestic appliance has been
30 allocated a current address DN, the information status I in
31 the bus line controller BM or in the bus master is now
32 updated and a normal information transmission NI takes place
33 from which the upper part of Fig. 2 starts. These
34 relationships shown in the lowest region in Fig. 2 initially

1 mean an updating and therefore synchronising of the
2 information status of the bus line controller BM by the
3 domestic appliance HG with optional further transmission W
4 of the relevant updating information IS to the personal
5 computer PC and then the subsequent transmission of
6 alteration information AI from the relevant domestic
7 appliance HG to the bus line controller BM and optionally
8 the further transmission W of this information to the
9 personal computer PC. This means that the bus line
10 controller BM only allows information to be received again
11 by the relevant domestic appliance HG after the previous
12 registration procedure RP.

13

14 [043] The cyclic interrogation ZA of the relevant domestic
15 appliance HG is now received again.

16

17 [044] Thus, after an interruption U or fault of a
18 communication connection with the domestic appliance HG has
19 been lifted, a new application and synchronisation takes
20 place between this domestic appliance HG and the bus line
21 controller BM. Thus, the local area network LAN between the
22 domestic appliance HG and the bus line controller BM
23 therefore automatically recovers to a certain extent from
24 the afore-mentioned interruption U or fault; self-healing
25 therefore takes place in relation to the interruption U or
26 fault.

27

28 [045] By means of the present invention, the user using the
29 personal computer according to Fig. 1 can therefore be
30 informed immediately about the actual status of the domestic
31 appliance or the domestic appliances by the bus line
32 controller BM. This means that the user can "trust" the
33 system since he is currently informed about its actual
34 status. The entire system responds dynamically to

1 communication faults or blockades and regenerates
2 automatically without interaction of the respective user
3 when the fault or interruption U is no longer present. If
4 the respective user does not call upon the system during the
5 time when a communication interruption exists, the
6 "blackout" remains invisible to him. This results in high
7 customer satisfaction since a high system availability is
8 provided.

9

10 [046]

11